2. BOOK REVIEWS

Parallel and Distributed Algorithms

M. Cosnard, Y. Robert, P. Quintan and M. Raynal (Eds.)

North-Holland, 1989, 344 pages, Price: U.S. $ 92.00, ISBN 0-444-87367-8

This book is based on the proceedings of the International Workshop "Parallel and Distributed Algorithms", held in October 1988 in Gers (France). It is organized in four parts: parallel algorithms, parallel sorting and searching, distributed algorithms, parallelization methods.

The book differs from the many proceedings volumes of recent conferences on Parallel Computing in two aspects:

— each part begins with an introductory paper written by one of the editors, in which the state-of-the art on that topic is presented (including an extensive bibliography) and in which the other papers are introduced.

— a part of the book is devoted to distributed systems, because the research and techniques in that field are important for parallel computing and vice versa.

In the part devoted to *parallel algorithms* (11 papers) mainly numerical algorithms are described both for shared memory and for distributed memory parallel computers, e.g. solving linear systems on Cray-2 and IBM 3090 and on transputer-based systems, solving sparse eigenvalue problems on Cray; systolic algorithms for matrix problems; parallelization of an aerodynamic application on IBM 3090/VF. Other papers describe programming environments and tools for the development of parallel algorithms, e.g. SCHEDULE (Argonne Nat. Lab.).

The part on *parallel sorting and searching* (6 papers) contains papers on the time complexity of parallel search algorithms on coarse grained networks, the implementation of a VLSI dictonary machine on a hypercube, the parallel solution of the knapsack problem and parallel branch and bound algorithms.

The part on *distributed algorithms* (6 papers) deals with algorithms structures, concepts and abstractions used in the design of distributed systems, e.g. total algorithms, decentralized concensus protocols, virtual time and global states of distributed systems. One paper describes the analysis of distributed algorithms by experimentation on a distributed memory parallel computer.

The last part of the book is devoted to *parallelization methods* (8 papers): parallel languages, design of systolic algorithms, automatic parallelization of nested loops, methods for computing data dependencies and parallel code generation, for process assignment and for loop scheduling.

Although the field of parallel and distributed computing is evolving very rapidly, many of the papers in this book contain important information, which is still valuable at present.

D. Roose

Factorization and Primality Testing

David M. Bressoud

Springer-Verlag, Undergraduate Texts in Mathematics, 1989, 237 pp., Price: DM 98 (Hardcover), ISBN 3-540-97040-1.

From the cover text: This book focuses on a single problem: how to factor a large integer or prove it is prime. From the Sieve of Eratosthenes of ancient Greece to the Multiple Polynomial Quadratic Sieve and the Elliptic Curve Methods discovered in the past few years, this self-contained text provides a survey of the heritage and an introduction to the current research in this field.

Apart from being an introduction to primality testing and factorization methods, this book also gives an excellent introduction to number theory: the Euclidean algorithm, perfect numbers, the Chinese Remainder Theorem and Quadratic Residues are only a few of the topics treated. It provides us with an overview of the classical and the most recent tests for primality and factorization techniques, each of which is translated into an algorithm that is easy to program, so that we can try out the different methods. The primality testing algorithms include: the pseudoprime and strong pseudoprime tests, the use of primitive roots, primality testing using continued fractions, Lucas' primality test. Some of the factorization techniques discussed: Fermat's algorithm, Pollard's Rho and p-1 algorithms, the Dixon-Pomerance Quadratic Sieve (with multiple polynomials) and the Bhascara-Brouncker continued fraction algorithm. In the last two chapters a more general approach to primality tests and factorization based on group theory is taken with as an example the Elliptic Curves method.

Not much preliminary knowledge of mathematics is required. For most theorems proofs are given, the most difficult ones are omitted.

This book is very well suited to be used as an introductory course on the subject. It contains many examples and a large number of exercises. However, there are some irritating misprints in the book which make some of the algorithms quite difficult to understand. I also had problems with a number of proofs which sometimes turn out to be very concise.

P. Levrie

Approximation, Optimization and Computing (Theory and Applications)
A.G. Law and C.L. Wang (eds.)
International Association for Mathematics and Computers in Simulation (IMACS)
North-Holland, Elsevier Science Publishers, Amsterdam and Elsevier Science Publishing Co. Inc., New-York, 1990, xvi+442 pages. Hard cover, Dfl.185.00/US $94.75. ISBN 0-444-88693-1.

Under the sponsorship of IMACS, a joint project was set up between the Dalian University of Technology (P.R. China) and the University of Regina (Canada) to bring together research papers reflecting emerging directions in approximation, optimization and computing. The result is the present volume which contains 101 short papers of that type.

There are 4 invited papers : *Multiple numerical integration formula using regular lattices* (S. Hitotumatu) *Asymptotic expansions of multiple integrals of rapidly oscillating functions* (L.C. Hsu) *Optimization theory for infinite dimensional set functions* (H.C. Lai) *Iterative computation in dynamic optimization* (E.S. Lee). The last one, which is 11 pages long, is the longest paper of the whole volume. All contributed papers are limited to four pages at most. It is clear that only smaller topics can be discussed within these space limitations, or, if a larger result is presented, it is only partially supported by proofs. Even the invited papers are not meant to be an introductory survey for the newcomer.

The contributed papers are classified in 4 groups. The largest one, on approximation, contains 51 papers. The most diverse subjects are discussed. One finds theory and techniques for interpolation, polynomial, rational and spline approximation, harmonic analysis, discrete and continuous approximation, differential and integral equations etc. The next part contains 22 papers on optimization with subjects of all kinds of mathematical programming problems, optimal control, stochastic programming and combinatorial problems. In the part on computing techniques there are only 8 papers. These discuss numerical aspects relevant for the solution on a computer of approximation and optimization problems. The last part contains 16 papers on experiments with certain methods on more practical problems.

Since the project was a Chinise-Canadian initiative, there are a lot of contributions (more than 50) by Chinese authors. The US and Canada contribute each about 10 papers. Other nationalities have their representatives, but it seems that only a limited number of people, not linked by co-authorship or otherwise to the project felt the need to send in a paper. Thus the book gives an idea of what some researchers are working on, but it need not be representative for the worldwide scientific community. It gives some information though on what is living currently in this particular research domain in the People's Republic of China.

A. Bultheel

Handbook of Numerical Analysis, Volume I. (Finite Difference Methods - part 1; Solution of Equations in $\mathbb{R}^n$ - part 1)
P.G. Ciarlet and J.L. Lions
North-Holland, Elsevier Science Publishers, Amsterdam and Elsevier Science Publishing Co. Inc., New-York, 1990. viii+652 pages. Hard cover, Dfl.220.00/US $107.25. ISBN 0-444-70366-7.

This is the first volume of a series which is set up to present all the major aspects of numerical analysis by accessible and in-depth surveys, including the most recent trends. The basic methods which are intended to be covered are grouped under one of the following general headings (1) Solution of equations in $\mathbb{R}^n$ (2) Finite difference methods (3) Finite element methods (4) Techniques of scientific computing and (5) Optimization theory and systems science. Besides these basic tools, also numerical methods for actual applied mathematical problems will be covered. These include (1) Fluids problems (2) Solids problems and (3) more specific applications like seismology etc. Each subject is treated in several articles, each one written by an expert. An article is a long survey with its own table of contents, bibliography and index. Since these are basically expository, only the very basic facts are proved. For many technical details, one is refered to the literature. In the same spirit, also the reference list is usually not exhaustive. The successive volumes are published as the articles become available. Therefore one shall not